

**CONFIDENTIAL**

2070125  
JED 1567

CORNING GLASS WORKS  
ELECTRO-OPTICS LABORATORY  
RALEIGH, NORTH CAROLINA

IMPROVED SCREEN FOR REAR PROJECTION VIEWERS



25X1

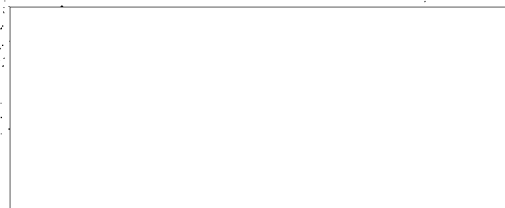
Dated 15 June 1965

Technical Report No.: 1

Date: August 27, 1965

Period Covered: July 15, 1965  
to  
August 15, 1965

EXCLUDED FROM AUTOMATIC  
R.GRADING; DOD DIR 5200.10  
DOES NOT APPLY



25X1

**CONFIDENTIAL**

THIS DOCUMENT CONTAINS INFORMATION AFFECTING  
THE NATIONAL DEFENSE OF THE UNITED STATES, WITHIN  
THE MEANING OF THE ESPIONAGE LAWS, TITLE 18, U.S.C.,  
SECTIONS 793 AND 794, THE TRANSMISSION OR REVELA-  
TION OF WHICH IN ANY MANNER TO AN UNAUTHORIZED  
PERSON IS PROHIBITED BY LAW.

**CONFIDENTIAL****I. Accomplishments****1. Literature Search****a. Open Literature**

The literature search commenced at the beginning of this period. Two main areas of investigation were defined; 1) articles directly related to projection screens and 2) articles concerned with the theoretical aspects of Mie scattering and laboratory measurements of the scattering properties of materials. Our Technical Librarian, Mr. Burriss, spent two days extending the search on screens, at the Library of Congress, Washington, D. C. As expected, only a minimum number of articles were found. These were made up of 16 patent references and 17 references to the open literature of which 5 are foreign. The foreign articles have both title and abstract in English.

Contrasted to this are some 150 articles relating to scattering, theoretical techniques, and laboratory methods; all of which are directly related to supporting future tasks. Because of astronomical quantities of this type of literature only those articles most closely related to specific tasks are being collected for retention.

**b. Patent Literature**

A patent search of both domestic and foreign literature from 1945 to date was initiated under the direction of [ ] of our patent department, Corning, New York. The actual search has been assigned to an outside firm in Washington, D. C. and have been instructed to complete the search at the earliest possible date.

25X1

**CONFIDENTIAL**

CONFIDENTIAL

-2-

## 2. Preliminary Theoretical Investigation: Screen Resolution

Projection screens are used to display large quantities of densely packed information which may be viewed directly or under additional magnification. Therefore it is essential that the display medium have sufficient resolution to present the required level of detail to the observer.

Modulation transfer function measurements have been extensively used to evaluate the resolution of optical systems and components over the last few years. The modulation transfer function (MTF) is a measure of how well the contrast of a particular size detail is transmitted through an optical system as a function of detail size.

Detail size is given in terms of spatial frequency in cycles or lines per millimeter of a pattern whose transmission varies sinusoidally with distance. In low resolution systems the contrast in the image is lost at a spatial frequency around 10 lines per millimeter while high resolution systems can adequately reproduce detail from 100 to 1000 lines per millimeter.

Many techniques have been developed for measuring the modulation transfer function. With only a few exceptions most work has been on image forming devices such as lenses, curved mirrors, telescopes, microscopes, projectors, etc. Comparatively little has been done to investigate non-imaging components like transparent plates, flat mirrors, and of primary interest, scattering materials. Because of the vast difference between conventional imaging system and scattering materials, these well established techniques must be re-examined as to their applicability.

CONFIDENTIAL

**CONFIDENTIAL**

-3-

Lenses are designed to be used at a given diameter, object distance and magnification. They are usually uniformly illuminated and almost all of the light incident on them passes through forming an image in one particular plane.

Quite a different situation is encountered when using a projection screen. It can never be uniformly illuminated if it is to display information. A significant portion of the incident energy is back-scattered toward the projector and that which passes through is re-distributed over an appreciable solid angle. All of the information displayed must be observed from many different directions and varying distances from the screen. Care must be taken because of these unique differences when measuring the modulation transfer function of scattering materials, because different techniques will give a different MTF for the material.

The following is a list of factors which can be expected to influence the measured MTF of a projection screen.

- a. Micro structure of scattering material
- b. Macro structure of scattering material
- c. Angle at which surface is viewed
- d. Distance from the surface
- e. How the material is illuminated
- f. Acceptance angle of measuring device
- g. Measurement techniques

Devices are commercially available for measuring the MTF of ordinary optical components but their applicability to this specific type of material is questioned. Theoretical studies are planned to properly define the conditions under which the modulation transfer function of scattering materials can be validly defined and measured. Thus the results of such a study must be understood before any attempt is made to acquire a device for making such measurements.

**CONFIDENTIAL**

### 3. Progress on a New Optical Fiber Screen Material

Conventional optical fibers consist of an inner core and a surrounding outer cladding of a lower refractive index material. The attenuation of light in a fiber is a complex phenomena but for practical purposes the internal losses are due to inherent properties of the dielectric core and not on imperfect internal reflections. A patent disclosure of a new type of optical fiber has been submitted by Corning Glass Works which is expected to largely circumvent this problem. This proposal is to use a hollow tube with a highly reflective inside wall. Losses are now governed only by the reflective properties of the coating, no longer by the loss tangent of the core and are therefore expected to be less than for an equivalent solid core fiber. This new type of optical fiber is being fabricated at our Danville, Virginia, facility. Re-drawing of the hollow Vycor brand glass tubes into fibers and their subsequent internal plating with Molybdenum has been started.

Techniques on how to assemble these individual fiber tubes into a matrix is presently under study. It is hoped these fibers can be bonded together in some way to produce an experimental rear projection screen.

### 4. Instrumentation

A Beckman DK-2 spectrophotometer with a reflectance attachment has been purchased by the Electro-Optics Laboratory of Corning Glass Works. This device will be used to measure the diffuse spectral transmittance and reflectance properties of sample screen materials. The integrating sphere and reference samples still require a coating of Magnesium oxide which is taken as the reference standard. The electronics have been checked and are in working condition.

**CONFIDENTIAL**

CONFIDENTIAL

-5-

The photometer attachment is on order and all remaining maintenance is expected to be completed prior to the commencement of any experimental work.

## II. Next Period Objectives

### 1. Literature Search

#### a. Open Literature

The necessary remaining literature will be collected during this period. Because of the time required between having the literature-in-hand and having it digested, a cut-off date will be set. Material received after this date, with a few possible exceptions, will have to be put aside until after the interim report. This cut-off date has been set as September 10.

Translations of the most important foreign articles will be started during this period.

#### b. Patent Literature

The report from Mr. Zebrowski covering the results of the patent search is due. This will contain only patent numbers and no patents as such. Therefore upon receipt of this the patent literature will be ordered.

### 2. Familiarization with Corning Manufacturing Facilities

Trips are planned to manufacturing plants at Corning, New York, and Danville, Virginia, to become familiar with some available Corning materials, techniques, and the limitation of the various manufacturing processes. Contacts will be made at each facility with those personnel who can later be contacted to provide additional information relating to Corning capabilities and the fabrication of samples as may be required during later phases of the program.

CONFIDENTIAL